The scattering and absorption properties of black carbon aggregates: from numerical aspect

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This study focuses on the scattering and absorption properties of black carbon (BC) aerosols, and presents the capabilities of numerical modeling on understanding BC optical properties. The effects of particle non-sphericity and inhomogeneity on BC optical properties are extensively discussed. Realistic BC particles can be well represented using the fractal aggregates, and various numerical models (e.g. RDG, MSTM, DDA, and et al.) with quite different accuracies are capable to simulate their corresponding optical properties. Those models used for light scattering properties of BC aggregates are systematically compared, and, by considering both the efficiency and accuracy, the MSTD shows great performances. The geometries of fractal aggregates are improved to account for particles minor structures (such as coating, different-sized monomers, monomer necking and overlapping) on the optical properties, and a simple numerical model is developed to consider the effects of non-absorption coating. Our results indicate that the non-sphericity and inhomogeneity of BC particles should be considered for further applications such as BC measurement and radiative transfer, whereas the minor structures are not as important as previously demonstrated.

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